The recovery of artifacts in Pleistocene-age soils directly below the plow zone in the test area east of the Phase III excavation area indicated that natural movement of artifacts had taken place at the site, and that the concentration of artifacts found in the Phase III section of the site was not unique, even though the subsoils in that area were post-Pleistocene in age. Based on this conclusion, no further excavation of sub-plow zone soils was undertaken at the site.

Methods. The plow zone of all units was removed and screened as a single stratigraphic unit. All levels below the plow zone were excavated in 5 cm arbitrary levels within natural levels. With the exception of the five units in which only the plow zone was excavated in order to obtain a larger sample of artifacts, all units were excavated until Pleistocene-age soils were encountered. If artifacts were found within 10 cm (2 levels) of this boundary, excavations continued until two continuously sterile levels were removed. If four continuous 5 cm levels were found to be sterile, excavation switch to 10 cm levels. In total, 51 1 m sq. test units were excavated within the center of Area A of the Brennan Site during Phase III investigations.

Each 1 m sq. unit was subdivided into four 50 cm sq. quadrants, labeled by the compass coordinates of its southeast corner. The quadrants were the minimum provenience unit. All excavated soils were screened through 1/4-inch mesh screen. A soil sample and one non-cultural rock were recovered from each level in each unit to be used as a control for blood residue analysis. Soil profiles were recorded for all units. Photographs were taken and maps were drawn of all potential features. Two 50 cm sq. quadrants from the north and south halves of the site were retained for flotation analysis, and two soil column samples were recovered from the same areas.

All soil and non-cultural rock samples were tested for false-positive blood residue reaction using protocols established at the University of Delaware Center for Archaeological Research (Custer, Ilgenfritz, and Doms 1988). In areas with no contamination, all tools and a sample of flakes were then tested for blood residue. After this process, all artifacts were washed and labeled according to standards established at the Island Field Museum.

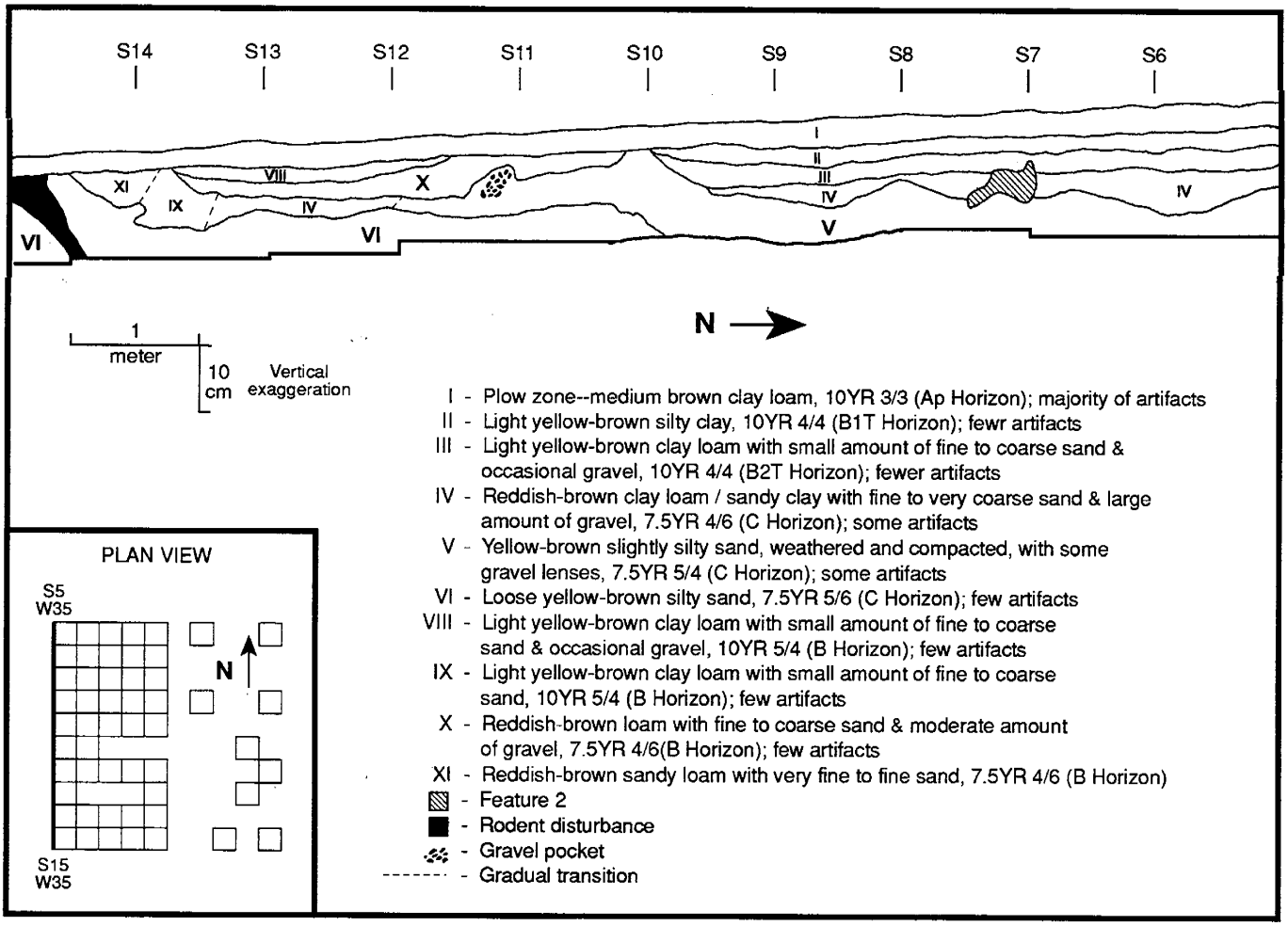
EXCAVATION RESULTS AND INTERPRETATIONS

Site Stratigraphy

Composite profiles of the Brennan Site stratigraphy are shown in Figures 8-11. Horizon I is the plow zone which covers the entire site to a fairly uniform depth of approximately 20 cm. The majority of artifacts recovered at the site came from the plow zone. Horizon II is a B1t soil horizon of yellow brown silty clay, which is underlain in the north by a yellow brown sandy clay/ clay loam — a B2t soil, labeled as Horizon III on the profiles. Both of Horizon II and III contained prehistoric artifacts, although in lesser amounts than the plow zone. Horizon IV is a B3t soil horizon, transitional between Horizon III and the depositional parent material (C soil horizon) below it. Horizon IV is reddish brown clayey sand which contains a moderate to large amount of gravel. Horizon IV has developed on what is most likely a late Pleistocene/Early Holocene gravel with illuviated clays. Under Horizon IV is yellow brown slightly silty sand (Horizon V).

FIGURE 8

North / South Composite Profile, West Side

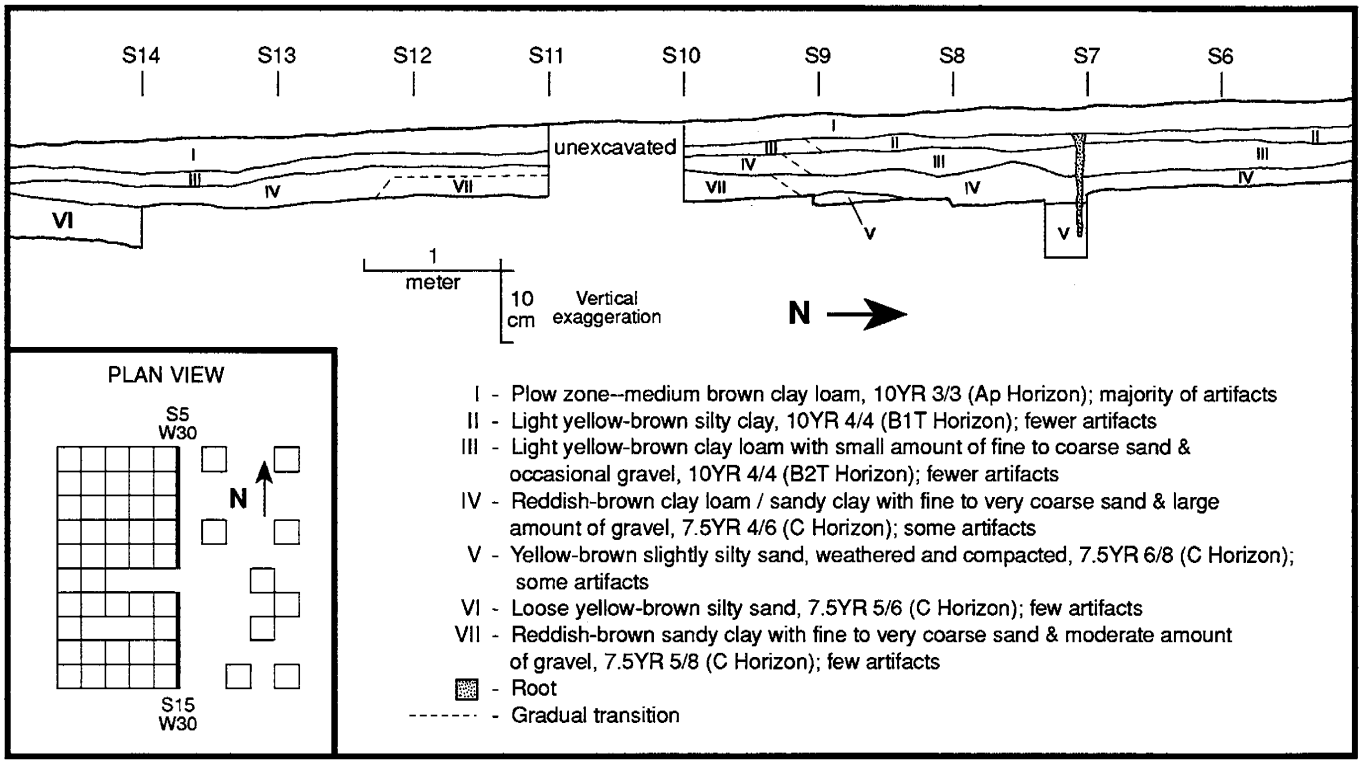


In the western part of the site near 10 m south of datum, Horizon V rises abruptly, and Horizons II through IV pinch out (Figure 8). A second C Horizon soil appears under V — an unconsolidated, yellow-brown silty sand labeled Horizon VI. To the east, there are more gradual soil changes, with Horizon II grading into Horizon III, and Horizon IV becoming redder in color and rising up (Figure 9). A reddish brown sandy clay also appears below Horizon IV in the east and is labeled as Horizon VII.

The disruption of the A_p-B-C profile found in the north half of the site may also be seen in the east/west profiles at 10 and 15 m south of datum (Figures 10 and 11). In Figure 10, Horizons III and IV dip downward to the west taking on a trough-like appearance, and two new horizons were found above them. Horizon VIII is a light yellow brown clay loam, over which is

FIGURE 9

North / South Composite Profile, East Side



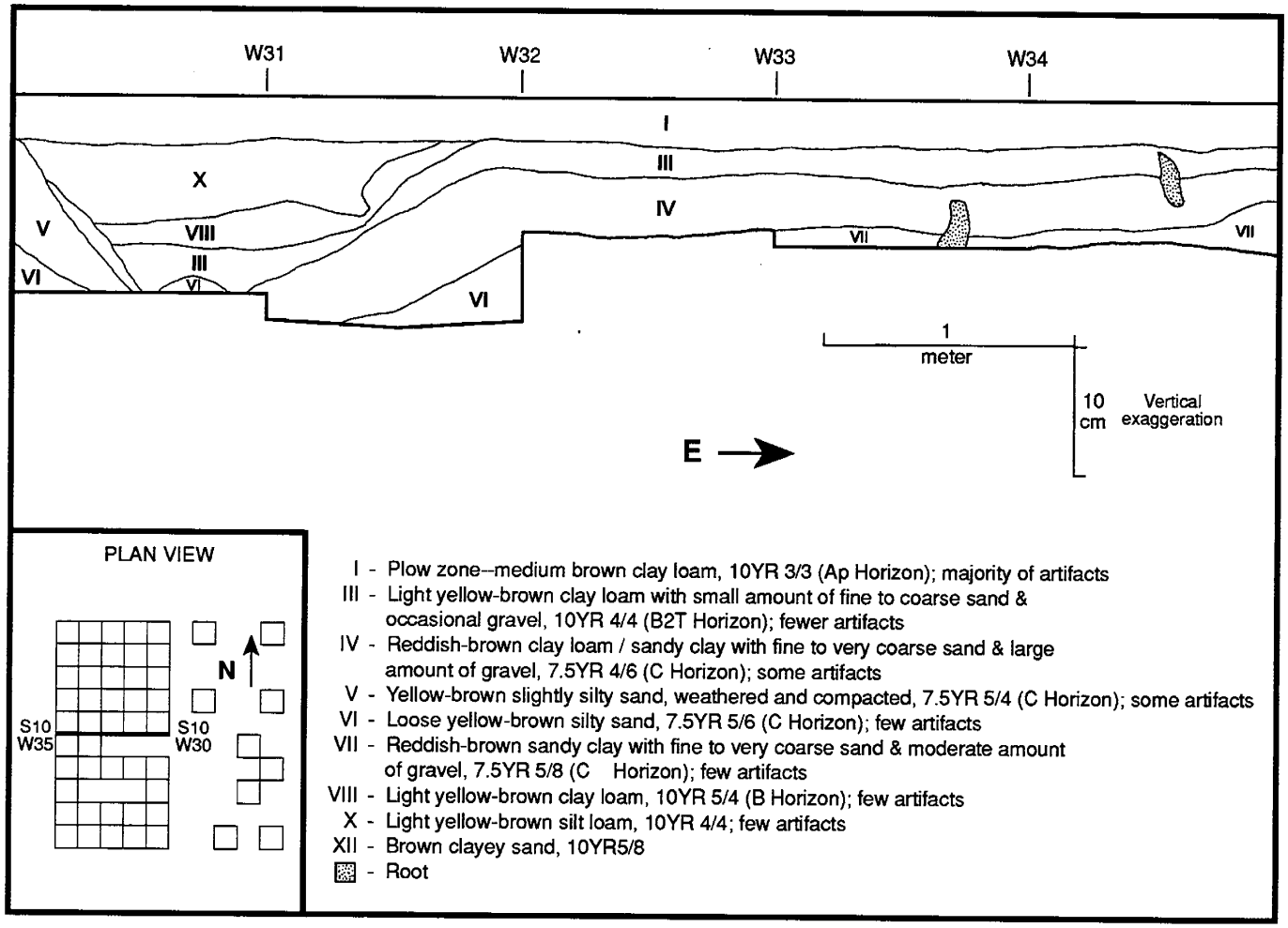
Horizon X, a light yellow brown silt loam. The amount of clay in these sediments suggests that they have undergone some soil development, but the sediments are probably depositional in origin. Horizon XII is a brown clayey sand, and may be intrusive.

A similar pattern may be seen in the southern east/west profile, except that Horizon VIII has expanded and has a slightly greater silt content. It is no longer underlain by Horizons III and IV, but rests directly on Horizon VI. Horizon VIII was originally thought to be a feature (see discussion of Feature 4 which follows) and it contained a small number of prehistoric artifacts to its deepest point, at 60 cm below the bottom of the plow zone. To the east, Horizon VIII grades into Horizon IV, and from that point east the soil profile is a less disturbed A_p-B-C sequence. The perturbations observable in Figure 11 are also visible in the south half of the western north/ south profile, with two additional pockets of clay and sand loam (Horizons IX and XI). Profile disturbance, in general, occupies the southwest corner of the excavation area (Figure 8 and 11).

In sum, soil profiles below the plow zone in the northwest, northeast, and southeast sections of the site consist of two, and sometimes three, Bt horizons, below which are a series of depositional C Horizons. The formation of the argillic B horizons suggests that soils in these areas have experienced a prolonged period of stability, and the amount of clay present in the

FIGURE 10

East / West Composite Profile, Middle Section

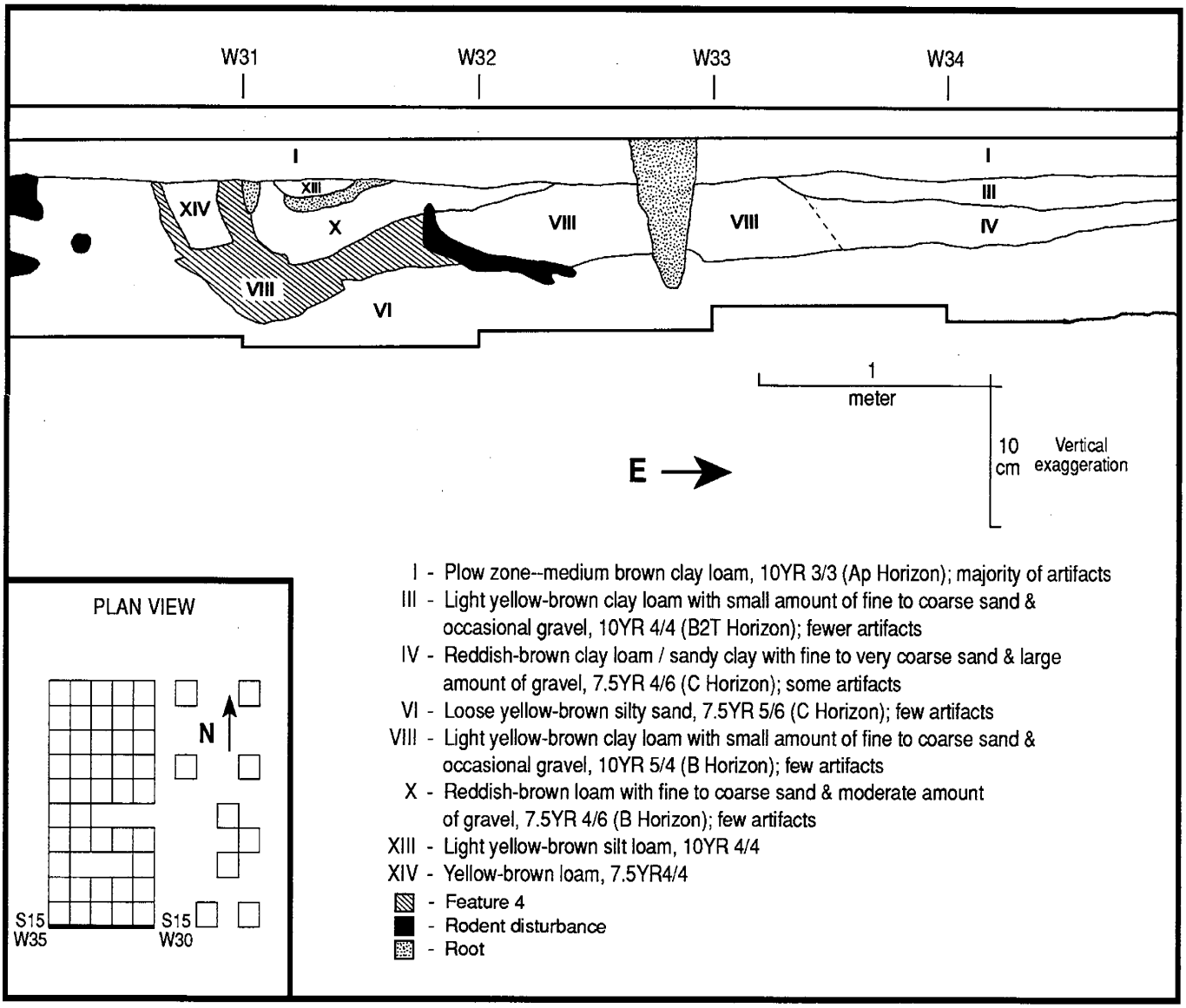


soils indicates that they are probably very old. The C horizons sediments below the soils horizons are depositional in origin, and are Columbia Formation deposits of Late Pleistocene/Early Holocene age.

The southwest corner of the site contains a series of soils in a trough or gully-like formation running northwest to southeast (Figure 12) which may represent a gully or ephemeral stream channel which was later filled with sediments. Evidence of some pedogenic development in the deposits (in Horizons X and VIII in Figure 11) suggests that the episode(s) of filling happened far enough in the past to have been completed before prehistoric people occupied the site. Although a small number of artifacts were recovered from these soils, this may be the result of the large amount of root and rodent disturbances in the area. No diagnostic artifacts were found below the plow zone at the Brennan Site.

FIGURE 11

East / West Composite Profile, Southern Section



Excavated Artifacts

A summary catalog of excavated artifacts from Phase III investigations is given in Table 3. The majority of lithic artifacts are flakes, but a small number of biface fragments, cores, and fire-cracked rock were also present. No projectile points or ceramics were found during Phase III excavations.

FIGURE 12

Southwest Corner
Soil Disturbance

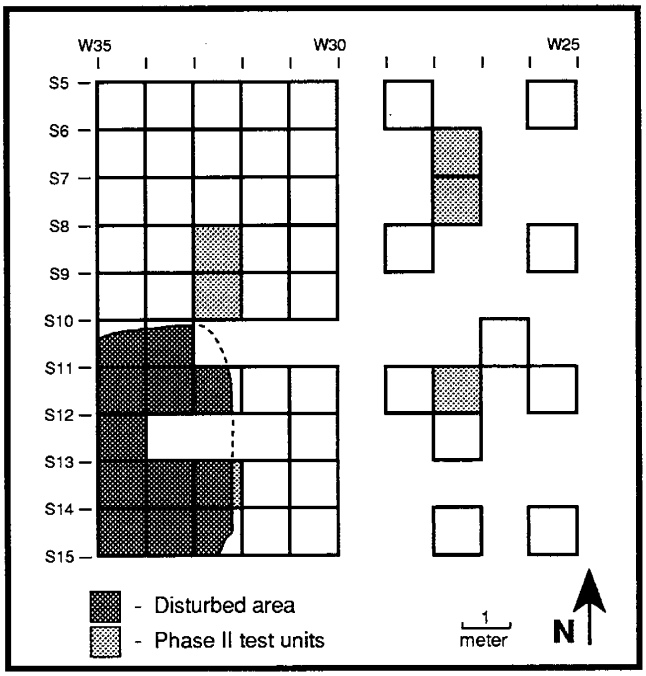


TABLE 3

Summary Catalogue for Phase III Excavations

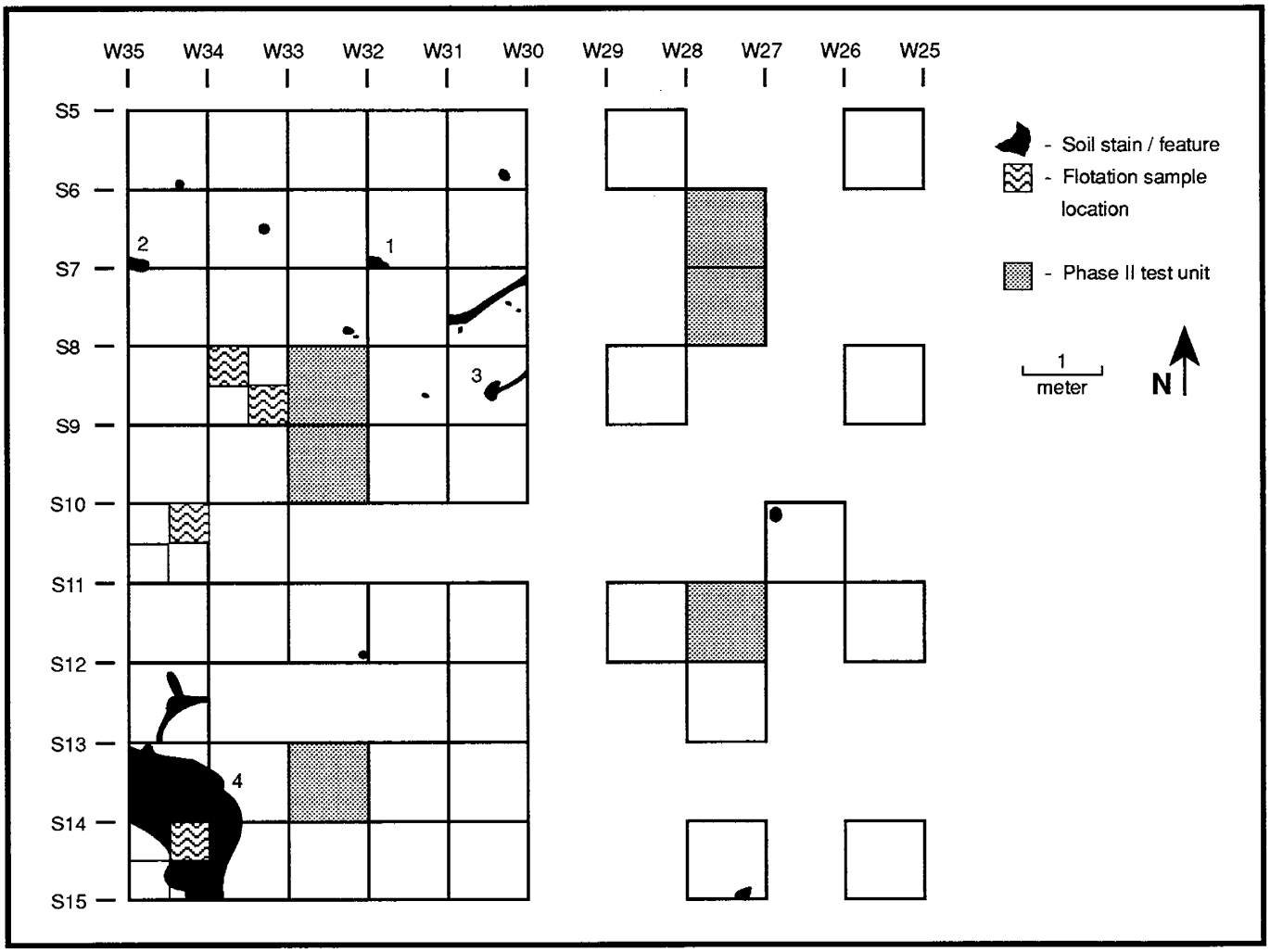
Artifact	Jasper	Quartz	Chert	Quartzite	Chalcedony	Other	Total
Points	---	---	---	---	---	---	---
Early stage biface reject	5	---	---	---	---	---	5
Late stage biface discard	1	---	---	---	---	---	1
Utilized flakes	24(1)	---	---	---	---	---	24(1)
Flake tools	12	---	---	---	---	---	12
Scrapers	1	---	---	---	---	---	1
Cores	3	---	---	---	---	---	3
Miscellaneous tools	---	---	---	---	---	1(1)	1(1)
Flakes	1844(12)	7(2)	2(1)	11(5)	10	1	1875(20)
Total	1890(13)	7(2)	2(1)	11(5)	10	2(1)	1922(22)

15 Fire-cracked rocks (3,950 g)
1 Hammerstone

KEY: ( ) = Cortex

FIGURE 13

Location of All Soil Stains and Flotation Samples



Features

Several potential features and soil stains were found in Phase III excavations (Figure 13). With one exception, all soil stains were determined to be the result of natural disturbances from tree root and rodent activity. During the excavation of Test Unit S15W33, an area of gray to orange-brown silty clay was observed in the western half of the unit at the bottom of Level 3, 10 cm below the bottom of the plow zone. This soil was excavated and screened separately to the bottom of Level 10 (45 cm below the base of the plow zone). Below Level 10 yellow-brown sands of Pleistocene age were exposed in the east half of the unit, but the gray to orange brown silty clay was still present in the west half of the unit. The remainder of the silty clay was excavated in 5 cm levels to a depth of 85 cm below the plow zone. The silty clay deposit was a steep-sided pocket of B Horizon soils which extended into units S14W33, S14W34, S15W34, S16W33, and S16W34.

Test units S14W33, S14W34, and S15W34 were opened and excavated to a depth of 35 cm below the plow zone, where the darker silty clay soil was discernible from the surrounding sandy soils. The silty clay soil was labeled Feature 4 (Figure 13). Excavation of the feature was completed in 5 cm levels that were screened separately within the boundaries of the test units in which Feature 4 was exposed. Flotation samples were also recovered from five 5 cm levels of Feature 4 (Levels 11, 12, 14, 15, and 16 in the NE quadrant of S15 W34). No artifacts were recovered from the screened soil from this feature. Two jasper microflakes and one quartz microflake were found in the heavy fractions of the flotation samples, as were two charred Amaranth seeds and 1.34 grams of charcoal (Table 4). Light fraction samples produced a number of charred Amaranth seeds as well as uncharred copperleaf (Acalypha rhomboidea) seeds.

The number of microflakes in Feature 4 is smaller than in other heavy fraction samples from non-feature soils, which is probably the result of the greater depth from which the Feature 4 samples came. The two kinds of lithic raw materials found in Feature 4 mirror the two most common found in non-feature samples. Although charred Amaranth seeds were recovered from Feature 4 light fractions, they were found in similar quantities in non-feature flotation samples. As in other flotation samples from the site, uncharred seeds were not analyzed.

In sum, the small number of artifacts and ecofacts recovered from Feature 4 are not unusual compared to other areas of the Brennan Site. Feature 4 appears as a steep-sided gully or trench-like soil anomaly, running in a NW to SE direction (Figure 12). In plan view its borders are irregular and its profile resembles an irregularly shaped basin. The irregular shape of the feature and the flotation data suggest that Feature 4 is natural, not cultural.

Floated Artifacts and Ecofacts

Flotation samples were taken from two test units and one possible feature at the Brennan Site (Figure 13). One 50 cm sq. quadrant from each of the units was selected, and all soil from that quadrant was bagged by 5 cm level and returned to the lab for processing. Each individual sample, therefore, contains 1.25 liters of sediment. All samples were then processed using a water driven flotation tank, with heavy fractions being collected in window mesh sized screen, and light fractions collected in a silk bag. After drying, all artifacts and ecofacts were removed and cataloged.

The majority of artifacts in the heavy fraction are jasper microflakes, with smaller amounts of quartz, quartzite, and chert microflakes included (Table 4). Small amounts of charcoal are also present, as are a single uncharred copperleaf seed, and a small number of charred Amaranth seeds (Table 4). Charred Amaranth seeds were also present in the light fraction samples, as were a variety of other uncharred seeds. As previously noted in the discussion of site stratigraphy, movement of artifacts through the profile has been demonstrated; therefore, the vertical position of artifacts and ecofacts from flotation will not be considered.

TABLE 4
Recovery from Flotation Samples

Heavy fraction

Square	Micro-debitage					Charcoal	Seeds
	Jasper	Quartz	Quartzite	Chert	Other		
S9W33 (5 samples)	48	1	1	---	1	0.15 gm	---
S11W34 (8 samples)	55	6(2)	1	2(1)	---	1.59 gm	---
Feature 4 (5 samples)	2	1(1)	---	---	---	1.34 gm	Amaranth (charred)
Total	105	8(3)	2	2(1)	1	3.08 gm	Copperleaf (uncharred)

Light fractions

Square	Seeds	
	Charred	Uncharred
S9W33	Amaranth	Copperleaf, *Stachys*, Chenopodium, Sandwort, Mulberry
S11W34	Amaranth	Copperleaf, *Stachys*, Chenopodium, *Oxalis stricta*
Feature 4	Amaranth	Copperleaf

Comparison between the raw materials of debitage recovered from flotation and debitage recovered from 1/4-inch mesh screens are interesting (Table 5). While jasper debitage is by far the most prevalent raw material found from both general excavation and flotation, the percentage of jasper debitage recovered from flotation is somewhat lower. Conversely, the amounts of quartz, quartzite, and chert debitage from flotation is higher. The presence of quartz and quartzite flakes in the general excavation debitage indicates that some reduction of quartz and quartzite took place at the site, but the higher percentage of these materials in flotation samples may reflect fracturing characteristics of different types of stone. The larger crystalline structure of quartz and quartzite rocks would produce smaller fragments during the early stages of tool manufacture compared to cryptocrystalline materials. The high incidence of cortex on the quartz microflakes (38% with cortex) is further indication of an early stage in cobble reduction. Microflakes resulting from tool edge sharpening would not be as likely to have cortex because the outer surfaces of the tool would already have been removed during an earlier stage of manufacture.

Jasper microflakes present in heavy flotation fraction samples indicate that edge sharpening of jasper tools took place. The physical characteristics of the small flakes match the jasper debitage found in general excavation. Given the problems with determining source locations of jasper from visual inspection (see discussion in "Technologies: Stone Tool Manufacture and Use" section), it is not possible to state with absolute certainty that the jasper microflakes are from the same source as the larger flakes recovered in general excavations at the site.

TABLE 5

Comparison of Excavation and Flotation Debitage

Raw Material	Number from Flotation	Percent from Flotation	Number from 1/ 4 -inch screen	Percent from 1/ 4-inch screen
Jasper	105	89%	1844(12)	98%
Quartz	8(3)	7%	7(2)	<1%
Quartzite	2	2%	11(5)	<1%
Chert	2(1)	2%	2(1)	<1%
Chalcedony	---	---	10	<1%
Other	1	<1%	1	<1%
Total	118(4)	100%	1875(20)	100%

In sum, the artifacts recovered from heavy fraction samples indicated that edge sharpening was performed on jasper tools. The tools sharpened may have been late stage bifaces, projectile points, or flake tools, all of which were produced at the site. It is also possible (but less likely) that finished jasper tools that were brought to the site were resharpened. Non-cryptocrystalline flakes at the site are small in number, and may be shatter from the early stages of tool production. The remaining microflakes, two chert and one rhyolite, are so few in number that conclusions about them are difficult.

As previously mentioned, a variety of uncharred seeds were recovered from the light fractions of flotation samples, as were charred Amaranth seeds. Because of the evidence of artifact movement through the profile, uncharred seeds were considered to be of questionable prehistoric cultural origin and were not analyzed further. The presence of charred Amaranth seeds is also questionable. The seeds were found in similar quantities in all three flotation sample locations, and did not come from cultural features. The charred Amaranth seeds may therefore represent natural seed "fallout" from the burning of surrounding areas (Custer, Stiner, and Watson 1983), and are not the products of prehistoric human activity.

Blood Residue Analysis

Tests for the presence or absence of blood residue on lithic artifacts was undertaken, using protocols developed by the University of Delaware Center For Archaeological Research (Custer, Ilgenfritz, and Doms 1988). A sample of soil and an unmodified (non-cultural) pebble from each level of every 1 m sq. excavation unit were first tested for possible organic or chemical contamination which might produce a false-positive reaction. All of the samples tested negative, or only slightly positive, suggesting that any strong positive reaction found on artifact surfaces would be a reliable indication of the presence of blood residues. A sample representing approximately 13% of the general debitage from the plow zone was tested first. An attempt was

made to test each individual flake three times on various surfaces, but the generally small size of the flakes resulted in most being tested only once. No strongly positive reactions were recorded for any of the plow zone debitage. The same procedure was repeated with a sample of the debitage from Level 2, with similar results. A small number of flakes below Level 2 were also tested, and did not produce positive reactions.

A small number of tools recovered from Phase III excavations were also tested for the presence of the blood residues. The major tool type at the site was utilized flakes, several of which were identified only after they had been thoroughly washed and were no longer suitable for blood residue testing. The utilized flakes that were tested produced negative results.

In summary, the results of blood residue testing for Brennan Site tools and debitage were negative. The results only indicate that blood residues are not now present on the artifacts, and no further interpretations are possible.

Site Chronology

Phase I/II testing at 7NC-F-61A recovered two stemmed projectile points from a plow zone context (Lothrop, Custer, and De Santis 1987). The points were found during a controlled surface collection, and no additional diagnostic artifacts were found during Phase III excavation of both plow zone and sub-plow zone soils. The projectile points are characteristic of the Woodland I cultural period, but were not sufficiently diagnostic to allow dating at the Complex level. One of the points is made from quartz, and has such an amorphous base form that it is not possible to type. The second point is made of jasper, and has a straight stem resembling the Bare Island/Lackawaxen type (Kinsey 1972:410) which are sometimes regarded as representing an individual component of the Late Archaic (Kinsey 1959, 1972:335, 337). Other research has indicated that the distinctions among stemmed point forms are not particularly diagnostic (Custer and Bachman 1984; Watson and Custer 1990). Therefore, only the general time frame of the Woodland I Period (3000 B.C. to A.D. 1000) was assigned to the site.

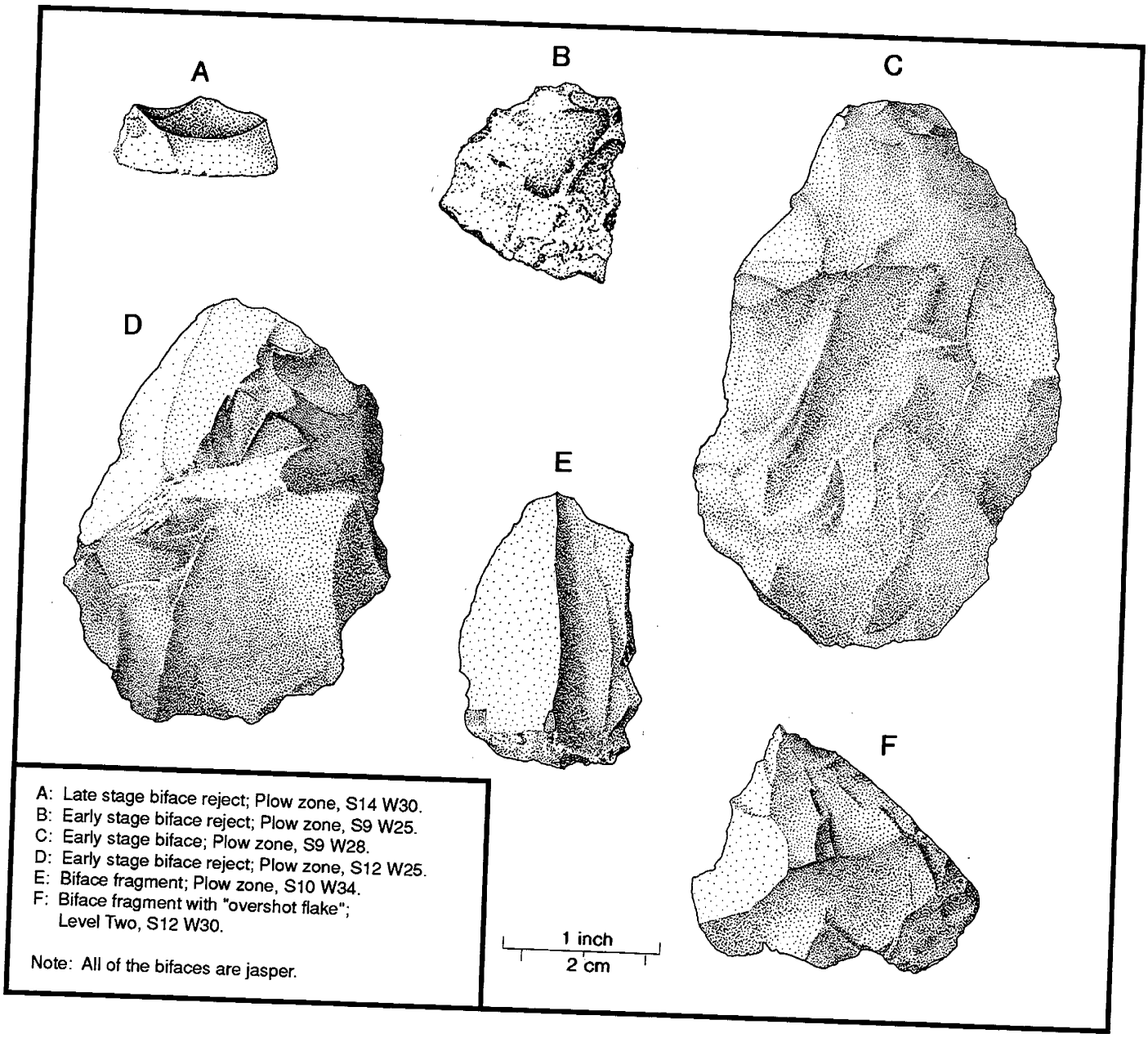
Unfortunately, no additional diagnostic artifacts were recovered from the Brennan Site during Phase III excavations, nor was any organic material suitable for radiocarbon dating found. Although the first prehistoric ceramic wares in Delaware were produced ca. 1200 B.C., the absence of ceramic wares at the Brennan Site does not necessarily imply an occupation date prior to 1200 B.C. because ceramic vessels are not expected on a site of this small size and limited function (Custer 1984:104). Thus, the age of the site can only be placed within the Woodland I Period.

Technologies: Stone Tool Manufacture and Use

This section of the report describes the stone tool manufacturing technologies and stone tool use which took place at the Brennan Site. It deals primarily with artifacts recovered from Phase III excavations. Bifaces and utilized flakes are considered in the context of tool

FIGURE 14

Bifaces



A: Late stage biface reject; Plow zone, S14 W30.
B: Early stage biface reject; Plow zone, S9 W25.
C: Early stage biface; Plow zone, S9 W28.
D: Early stage biface reject; Plow zone, S12 W25.
E: Biface fragment; Plow zone, S10 W34.
F: Biface fragment with "overshot flake"; Level Two, S12 W30.

Note: All of the bifaces are jasper.

manufacturing activities, and this information, combined with the analysis of other artifact types, is used to determine stone tool functions. Finally, the stone tool technology is considered in relation to the lithic raw materials present at the site which reflects lithic procurement strategies. Tool function was determined by examining breakage patterns and edge wear. Analysis of gross morphology and wear patterns was carried out by visual and microscopic inspection.

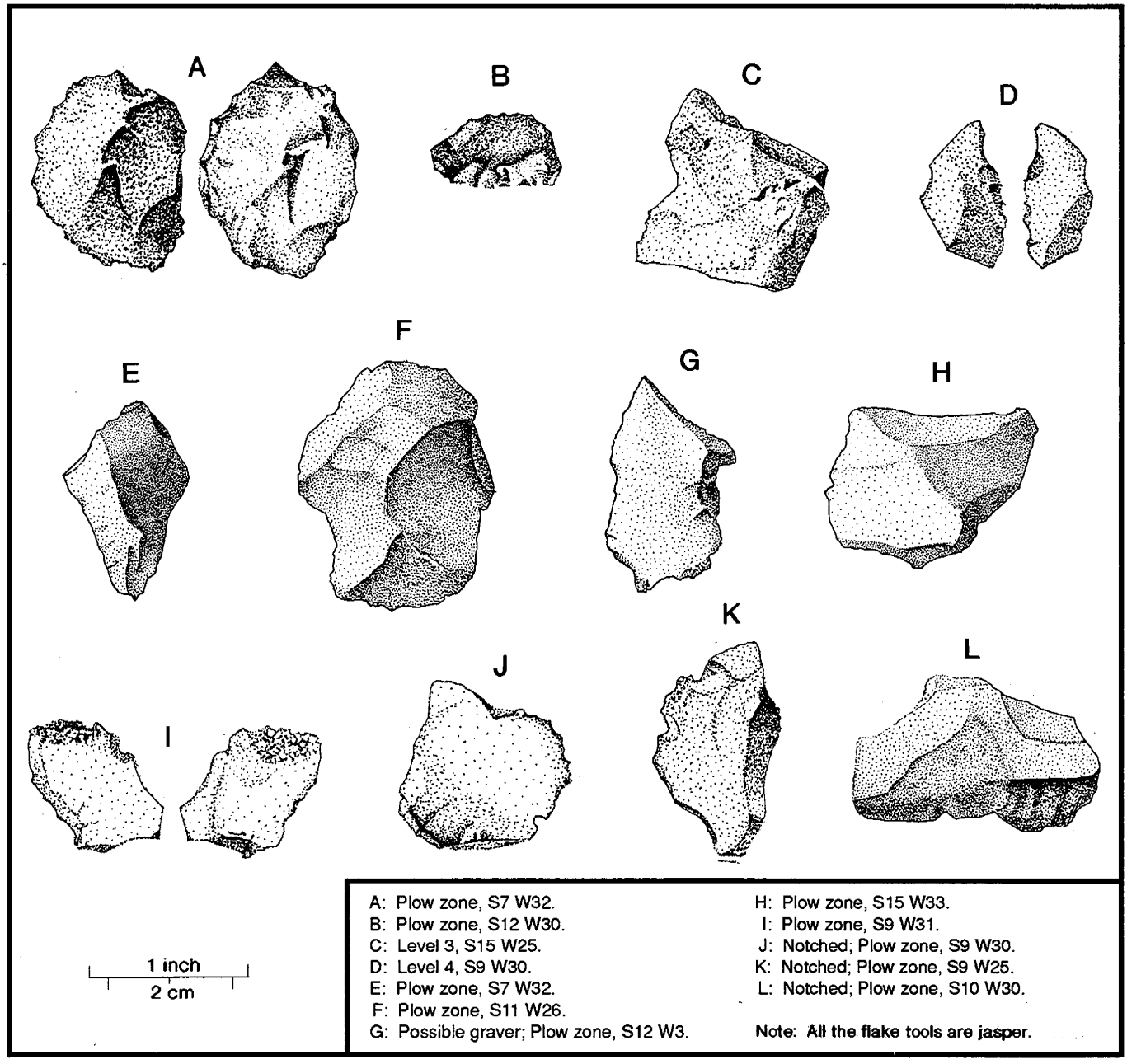
No projectile points were found during final data recovery excavations at the Brennan Site. The two points recovered during Phase II excavations (one quartz, and one jasper) were both discarded stemmed points with transverse fractures in the medial section. Both of the points were found outside of the Phase III excavation area. A total of six bifaces — two whole and four broken — were found during Phase III work. The bifaces were categorized by manufacturing stage and motive for disposal based on the work of Callahan (1979). Figure 14-A shows a discarded late stage biface with a transverse fracture. It is probably the base of a projectile point. Three of the five early stage bifaces in the Phase III assemblage are fragments rejected due to manufacturing error, most likely exacerbated by flaws in the raw material (Figure 14-B, E, F). One of these fragments (Figure 14-F) apparently resulted from a type of reduction error described by Callahan (1979:76, 86) as "overshot termination," in which a lateral thinning flake accidentally removes the opposite side of the biface. He also notes that while this is a common problem during early stage biface reduction, it does not necessarily prevent further reduction of the biface. The remaining two bifaces are whole, and were manufactured from large flakes which still retain their original platforms. One of the bifacially worked flakes (Figure 14-D) has what appears to be two additional partially prepared platforms. The biface may not have been further reduced because of iron mineral inclusions in the stone. None of the bifaces recovered from the site show signs of use, and all were made of jasper. Two small, late stage jasper bifaces were also recovered during Phase I and II investigations. They were apparently rejected due to raw material flaws which prevented further reduction.

Twelve modified flake tools were found at the Brennan Site; ten from the plow zone, and two from sub-plow zone contexts (Figure 15). All of the flake tools have been unifacially reworked to a small degree. Four of the twelve have been utilized in two places (Figure 15-F, G, J, K) and one of these (Figure 15-G) is a multipurpose tool with both a cutting edge and a graver tip. The remainder of the flake tools show wear on only one edge. They are all made of jasper, and all show moderate wear, except one which shows heavy wear (Figure 15-E).

Four of the flake tools appear to be special purpose implements (Figure 15-I, J, K, L). Each of the tools has had a single flake removed from a lateral edge of the dorsal surface, creating a small concavity or notch which was then utilized. The wear visible on the notches is moderate, and all of the flakes are small in diameter (3 to 4 mm). Two of the flakes (Figure 15-J, K) also show evidence of edge wear but it is likely that this wear is not the cause of the wear visible in the notch. Tringham et al. (1974:180) show an experimental flake with an edge worn from cutting in a longitudinal direction, which is similar to the wear on the notched flakes at the Brennan Site. The experimental flake also has a concavity or notch along the utilized edge, but there is no wear in the concavity.

FIGURE 15

Flake Tools

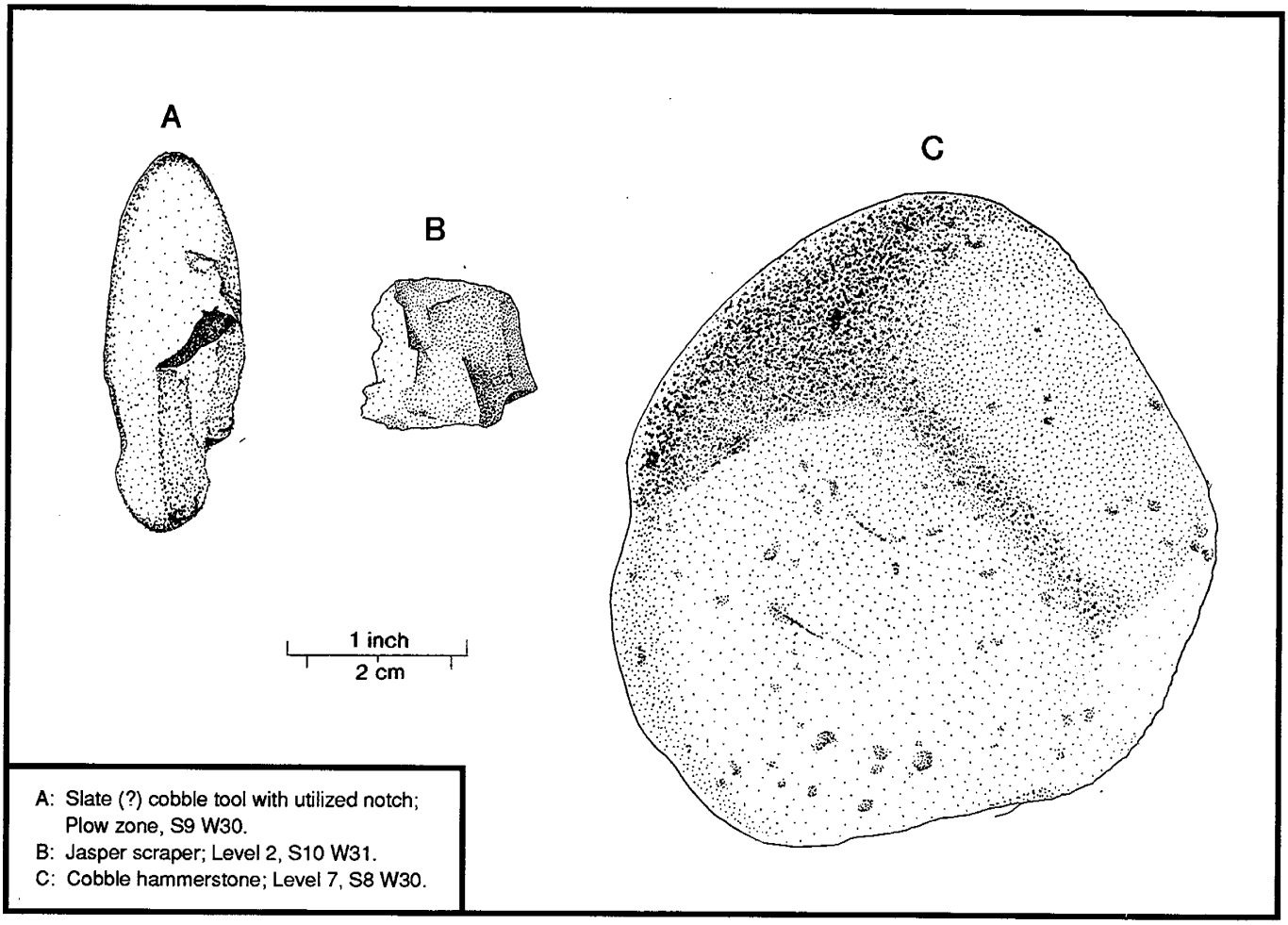


A: Plow zone, S7 W32.
B: Plow zone, S12 W30.
C: Level 3, S15 W25.
D: Level 4, S9 W30.
E: Plow zone, S7 W32.
F: Plow zone, S11 W26.
G: Possible graver; Plow zone, S12 W3.
H: Plow zone, S15 W33.
I: Plow zone, S9 W31.
J: Notched; Plow zone, S9 W30.
K: Notched; Plow zone, S9 W25.
L: Notched; Plow zone, S10 W30.

Note: All the flake tools are jasper.

FIGURE 16

Miscellaneous Stone Tools



A: Slate (?) cobble tool with utilized notch; Plow zone, S9 W30.
B: Jasper scraper; Level 2, S10 W31.
C: Cobble hammerstone; Level 7, S8 W30.

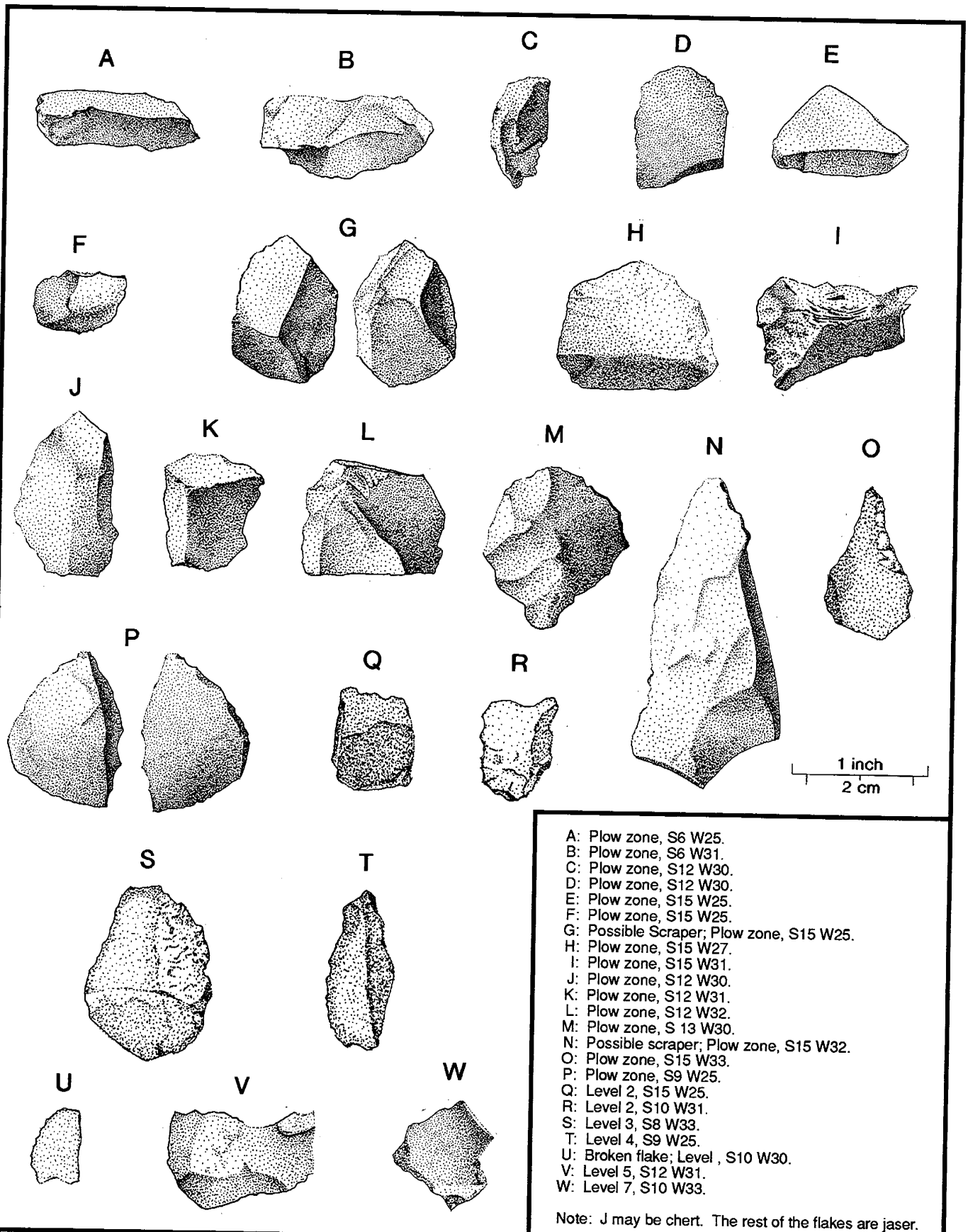
A larger, worn utilized notch appears on the single cobble tool found at the site (Figure 16-A). The cobble is small (5 cm long) and is made of slate. One jasper scraper was also recovered; it is blocky, unifacially worked, and shows light, medium, and heavy wear on three sides respectively (Figure 16-B). The steep edge angle and amount of wear on the scraper is characteristic of use on hard material such as bone or wood (Wilmsen 1970:71; Odell 1980:411).

Unmodified, utilized flakes comprise the largest single class of tools at the Brennan Site; the 24 recovered represent 55% of all tools, and 1% of the total amount of debitage (Figure 17). All of the utilized flakes are made of jasper, and most show light to moderate wear.

Three jasper cores were found during Phase III excavations at the Brennan Site (Figure 18). All of the cores appear exhausted, two because of inclusions in the raw material (Figure 18-A, B) and one because of small size (Figure 18-C). Also illustrated is a larger jasper core found

FIGURE 17

Utilized Flakes

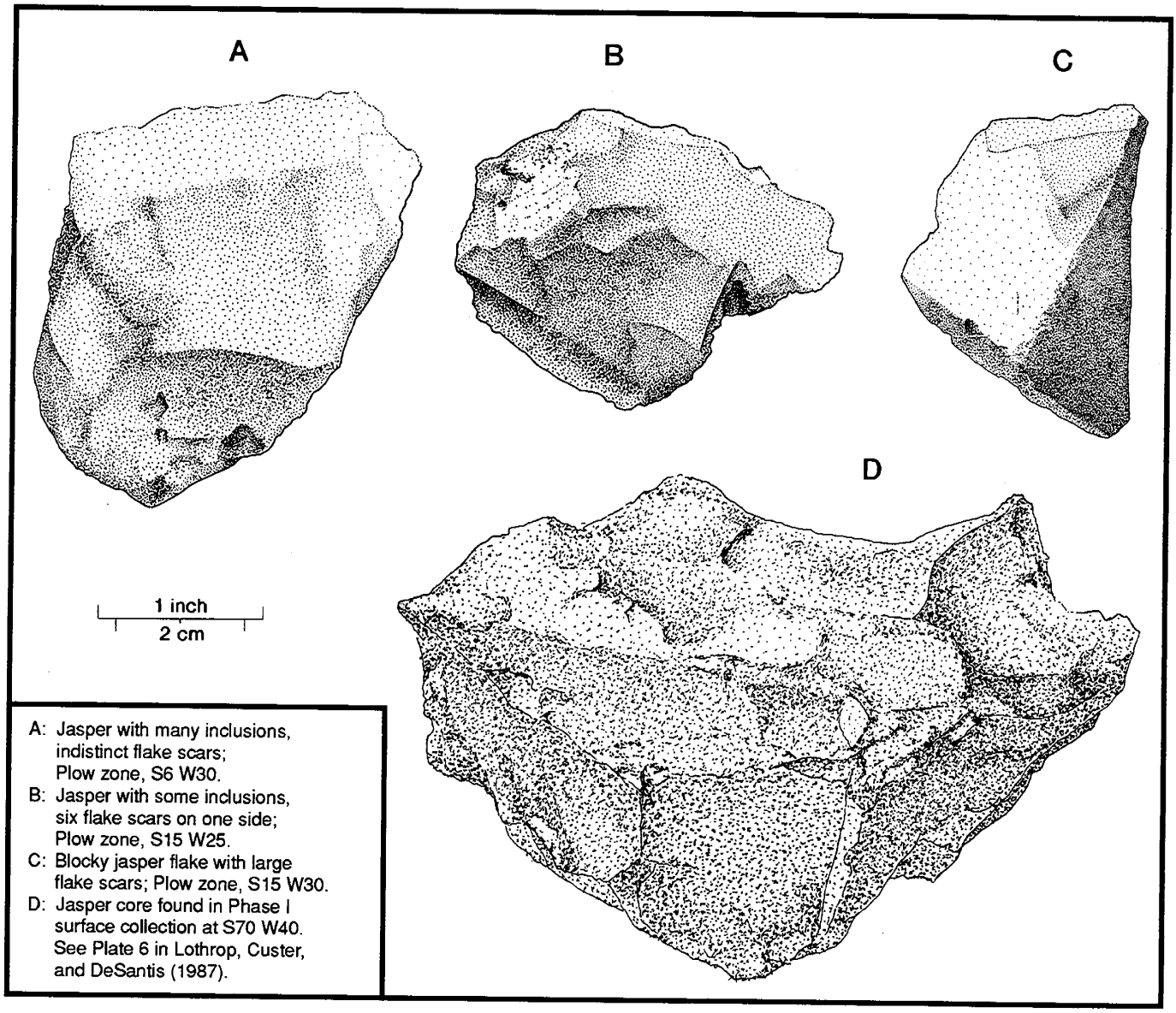


A: Plow zone, S6 W25.
B: Plow zone, S6 W31.
C: Plow zone, S12 W30.
D: Plow zone, S12 W30.
E: Plow zone, S15 W25.
F: Plow zone, S15 W25.
G: Possible Scraper; Plow zone, S15 W25.
H: Plow zone, S15 W27.
I: Plow zone, S15 W31.
J: Plow zone, S12 W30.
K: Plow zone, S12 W31.
L: Plow zone, S12 W32.
M: Plow zone, S 13 W30.
N: Possible scraper; Plow zone, S15 W32.
O: Plow zone, S15 W33.
P: Plow zone, S9 W25.
Q: Level 2, S15 W25.
R: Level 2, S10 W31.
S: Level 3, S8 W33.
T: Level 4, S9 W25.
U: Broken flake; Level , S10 W30.
V: Level 5, S12 W31.
W: Level 7, S10 W33.

Note: J may be chert. The rest of the flakes are jaser.

FIGURE 18

Cores



during the Phase II controlled surface collection (Figure 18-D). This core, which weighs 475 grams, was most likely derived from a large primary flake produced at a quarry site, although clear evidence has been obscured by the later removal of flakes. Flake scars appear on two of the four faces of the core from which flakes could have been removed. Although the core does not appear to have been completely exhausted, inclusions in the jasper have limited the amount of potential flakes remaining. There are no signs of prepared platforms on the core.

TABLE 6

Flake Attribute Analysis Results for the Brennan Site

Flake type		**Size**		**Platform shape**		**Platform preparation**	
Complete	67	<2 cm	108	Triangular	42	Present	13
Proximal	43	2-5 cm	85	Flat	28	Absent	95
Medial	45	>5 cm	7	Round	38	No observation	92
Distal	45			No observation	92		
		Scar count				**Directions count**	
Cortex		Mean	= 1.78	**Remnant biface edge**		Mean	= 1.51
Present	0	Standard deviation	= 0.78	Present	5	Standard deviation	=0.70
Absent	200			Absent	195		

Note: This table is based on a sample of 200 flakes

A flake attribute analysis based on the work of Verrey (1986), Magne (1981, 1985), and Gunn and Mahula (1977) and designed to indicate whether debitage derived from bifaces or from cores was conducted on a random sample of 200 unmodified flakes from the Brennan Site assemblage (Table 6). A summary of the results is given below. More detailed discussion of the flake attribute analysis is given in the conclusions.

The high percentage of broken flakes in the sample (66%) suggests biface reduction. There was a total absence of cortex on the sample flakes indicating that they were not derived from cobble cores. The majority of flakes (54%) were quite small indicating that they were not derived from either large early stage bifaces or large cores; however, a significant percentage (43%) were medium sized indicating that they could have resulted from later stages of biface reduction. The mean flake scar count is 1.78 with a standard deviation of 0.78. Unfortunately, this value is not indicative of either biface or core reduction. On the other hand, the mean directional count of 1.51 is more typical of biface reduction than it is of core reduction. Triangular platforms, associated with biface reduction, were present on 21% of the flakes; round platforms, associated with early stages of biface reduction, were present on 19% of the flakes; and flat platforms, associated with core reduction, were present on 14% of the sample. Remnant biface edges were present on 3% of the sample flakes. Platform preparation, which is more typical of biface than of core reduction, is present on 7% of the sample flakes. In sum, the analysis of the flake assemblage indicates that much of the debitage and most flake blanks used to produce tools were derived from biface reduction, although a significant degree of core reduction is also indicated. Results of the flake attribute analysis suggest that both bifaces and cores were being reduced at the site and both played important roles in filling the lithic needs of the site's occupants.

The presence of small microflakes in flotation samples indicates that the resharpening of tools manufactured from quartz, quartzite, and chert, as well as jasper, took place at the Brennan Site (Table 5). It is interesting to note that the relative amounts of non-jasper microdebitage are somewhat higher than for general debitage. This may be an indication that finished tools made of these materials, which had been manufactured elsewhere, were being refurbished while new jasper tools were being produced.

TABLE 7

Cortex Frequencies on Raw Materials

	Jasper	Quartzite	Chalcedony	Quartz	Chert	Other	Total
Number	1890(13)	11(5)	10	7(2)	2(1)	2(1)	1922(22)
Percent with Cortex	<1%	45%	0%	29%	50%	50%	1%

The source of the raw material for the tools and debitage at the Brennan Site is the primary outcrops of high quality cryptocrystalline stone in the vicinity of Iron Hill, Delaware and northeastern Cecil County, Maryland. These outcrops, traditionally referred to as the " Delaware Chalcedony Complex," have been a focus of prehistoric lithic procurement from Paleo-Indian through Woodland II times (Wilkens 1976; Custer and Galasso 1980; Custer 1980, 1983; Custer, Ward, and Watson 1986). Although it is not possible to state with absolute certainty that the jasper recovered at the Brennan Site came from the Delaware Chalcedony Complex outcrops, there are at least two reasons for believing so. The first reason concerns the geological source from which the jasper at the site originated. The nearly total absence of cortex on jasper artifacts from the site (Table 7) indicates that the material came from a primary source and not from secondary cobble deposits. Outcrops of the Delaware Chalcedony Complex are the nearest source of primary jaspers (8 km to the north); the next closest source of primary jasper is approximately 100 km to the north.

The second reason concerns the characteristics of the jasper itself. The jasper used for artifacts at the Brennan Site is fairly uniform in color, texture, and the amount and type of inclusion. While it has been argued that macroscopic inspection of jasper is insufficient to determine particular quarry sources, jasper with the same physical characteristics as the jasper at the Brennan Site has been observed at outcrops of the Delaware Chalcedony Complex (Custer, Ward, and Watson 1986). The physical uniformity of the jasper at the Brennan Site also indicates a primary source: jasper derived from cobbles would probably be more variable.

The color of jasper from the Delaware Chalcedony Complex ranges from brown to yellow to red, and is determined by the chemical variability of the material. The jasper found at the Brennan Site almost uniformly red in color. The red color in jaspers can result from recrystallization of minerals from exposure to heat, but this does not seem to be the case for the material from the Brennan Site. Hatch and Miller (1985) tested samples of jasper debitage from various locations at the Vera Cruz jasper quarry in Lehigh County, Pennsylvania for evidence of heat treatment. The highest percentage of thermally-altered flakes from various stages of biface reduction, was 81.1%. However, over 93% of Hatch and Miller's (1985) samples showed less than 50% reddening from heat treatment. In contrast, at the Brennan Site nearly 100% of the flakes are red. In addition, none of the other characteristics of thermal alteration, such as micro-

cracking or "potlidding", are visible in the jasper from the Brennan Site. It is therefore likely that the color of the flakes at the site is a function of their chemical make-up, and not a result of heat treatment.

Unutilized debitage at the Brennan Site is the product of biface reduction and the reduction of cores. Jasper flakes accounted for 98% of the total amount of debitage recovered, with the remaining 2% being composed of small amounts of quartzite, chalcedony, quartz, and chert (Table 2). Specifically, the jasper flakes resulted from the reduction of early stage bifaces, and the possible manufacture and resharpening of projectile points. They also derived from the reduction of jasper cores, most likely for the production of flakes for use as tools. The presence of small amounts of non-jasper debitage indicates that these other materials, which probably derived from cobbles, were also being utilized to a small degree. However, the absence of tools made from these materials makes it difficult to identify the end product of their reduction.

The majority of bifaces recovered during Phase II and Phase III excavations were early stage forms which were rejected during the process of reduction. The morphology of some of the larger, intact bifaces suggests that they arrived at the site in the form of prepared bifaces made from large primary flakes. While at the site, the bifaces were further reduced to some degree, possibly into projectile points made to replace broken points culled from the group's tool kits. The two broken points found during Phase II excavations, and the fractured late stage biface found during final data recovery, are probably examples of discarded tools. The number of discarded late stage bifaces and projectile points is low, however, which suggests that bifacial tool manufacture and replacement was not performed on a large scale. This supposition is also supported by the small number of bifaces that were rejected in the later stages of manufacture. Only two late stage biface rejects were found during Phase I and II field work; none were found during Phase III excavations.

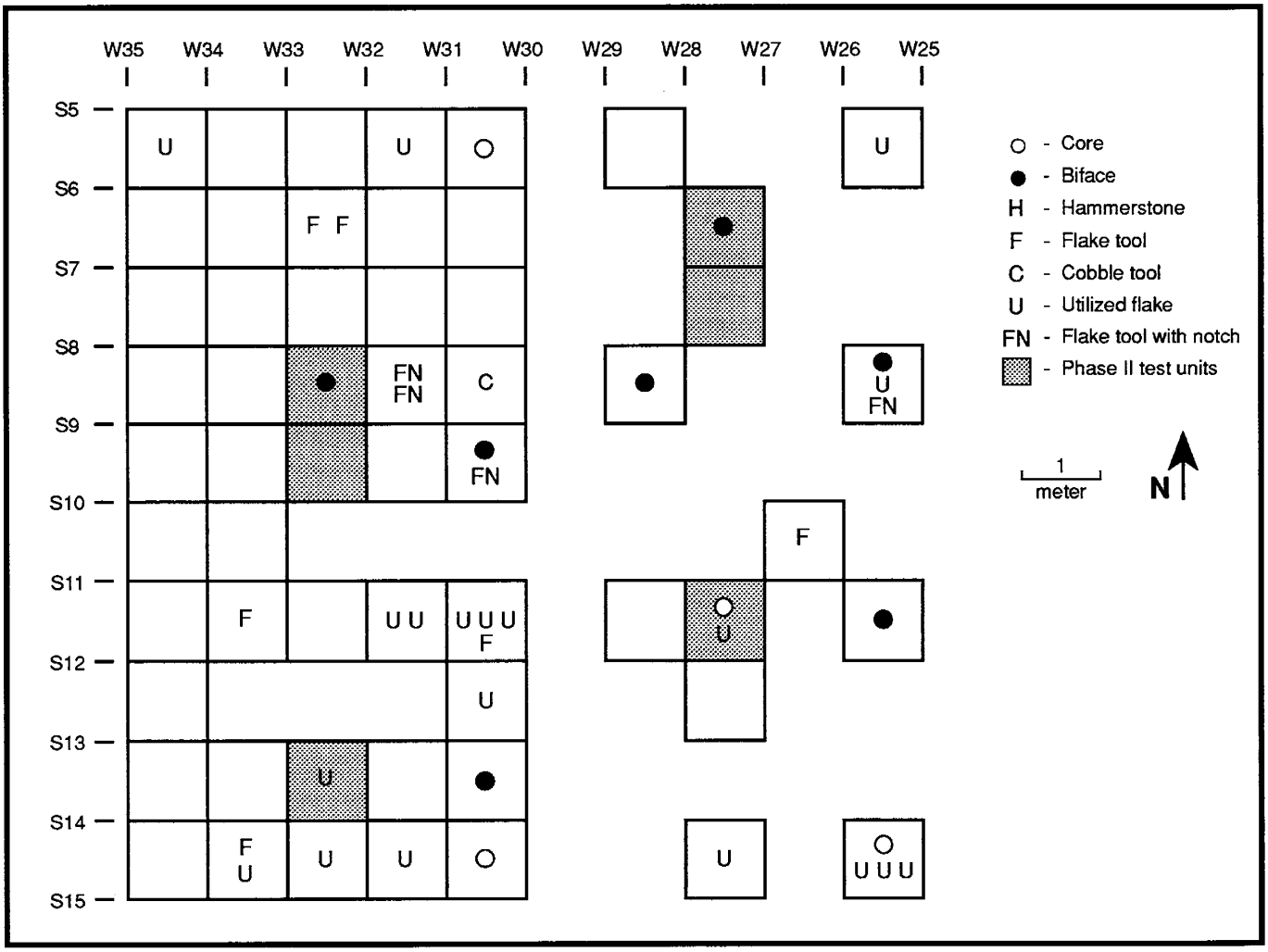
Other sites in the area near the Delaware Chalcedony Complex — both larger than (7NC-D-3, 7NC-D-5) and of a similar size (7NC-D-19) to the Brennan Site — have a much higher numbers of both early and late stage rejected bifaces, as well as discarded tools (Custer, Ward, and Watson 1986). Systematic, controlled excavations have not been performed at most jasper reduction sites in and around the Delaware Chalcedony Complex, so direct comparisons between sites for the occurrence of various artifact types are not possible. However, examination of uncontrolled surface collections from sites within 2-3 km of the jasper outcrops indicates that the reduction of primary bifaces into both later stage bifaces and finished tools took place to a greater degree than found at the Brennan Site.

Jasper cores were brought to the Brennan Site, probably in a quickly prepared, amorphous form and were reduced to produce flakes. The cores are the likely source of the utilized flakes and modified flake tools found during Phase II and III excavations. It is also possible that the cores themselves were later bifacially worked into tools.

The large numbers of flake tools and utilized flakes at the site gives some indication of the additional activities taking place. Food preparation operations, such as butchering or animal processing, are suggested, but the absence of tools used in the initial stages of butchering indicates

FIGURE 19

Distribution of Tools, Level 1, Plow Zone

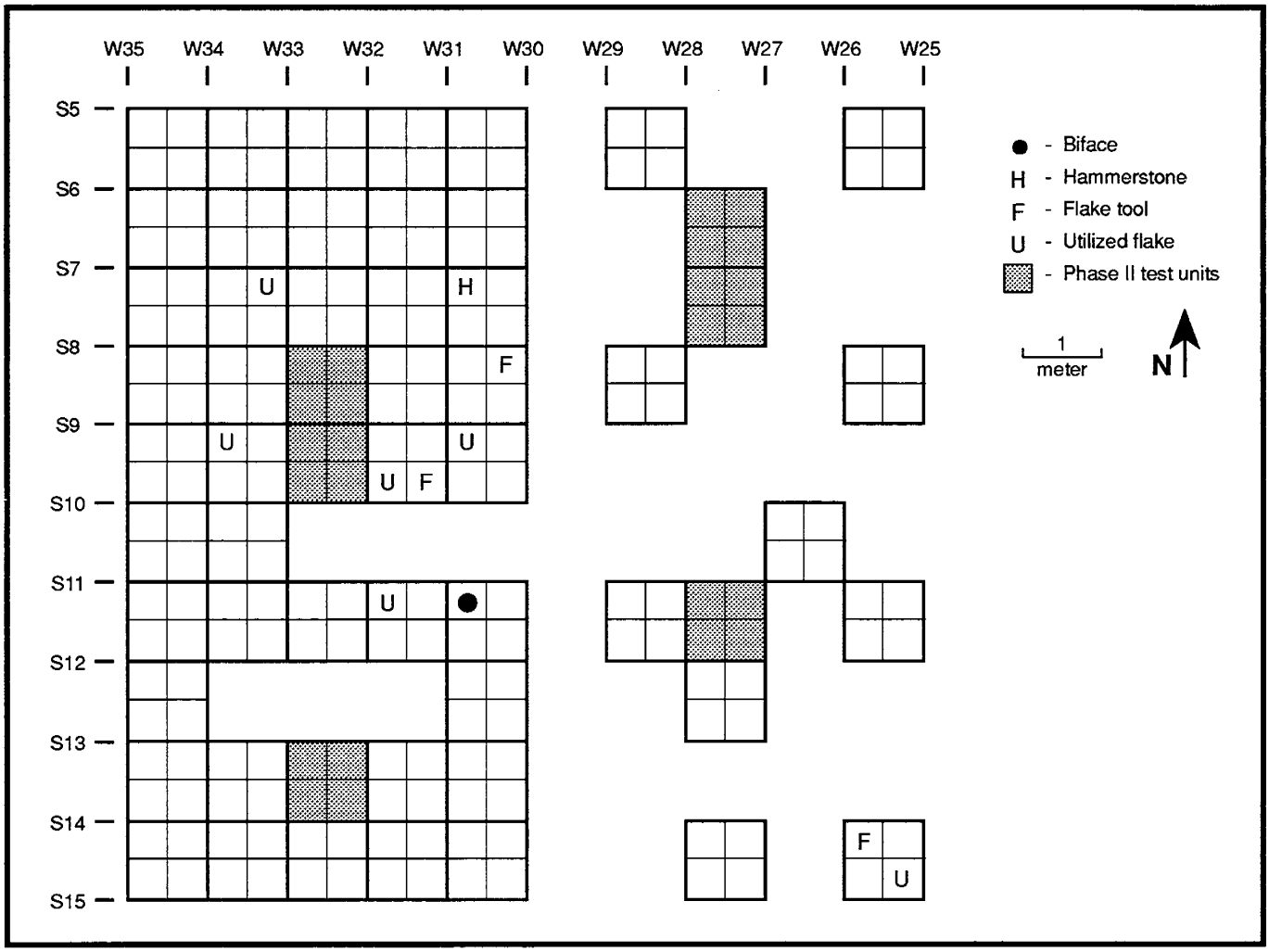


that butchering was carried out elsewhere. Only secondary cutting and slicing operations were performed at the Brennan Site. The small amount of wear on most tools indicates that they were expediently used, as might be expected in a situation where high quality raw materials were readily available. Only one multi-purpose flake tool was found — further evidence that tools were not heavily curated.

Flake tools and utilized flakes may have also been involved in the manufacture of non-lithic tools. In particular, the four notched flake tools and the notched cobble tool could have been used to produce other tools of bone or wood, such as awls or needles. The jasper scraper recovered from the site may also have been used on bone or wood.

FIGURE 20

Distribution of Tools, Level 2, Below Plow Zone



The rejected bifaces, cores, and large amounts of debitage found at the Brennan Site indicate that stone tool manufacturing was a major activity of the group or groups which inhabited it. The presence of other types of tools indicates that other activities took place there as well. In sum, the major activity taking place at the Brennan Site was the reduction of bifaces and cores into replacement and expedient tools. Groups came to the site with prepared early stage bifaces and cores transported from nearby primary jasper outcrops of the Delaware Chalcedony Complex. The bifaces were then reduced into later stage bifaces and finished tools, sometimes unsuccessfully. Some exhausted and broken tools were discarded, and existing tools were refurbished. Flakes were produced from the cores, and were then used in animal and plant food processing. The presence of charred seeds in flotation samples may also indicate the use of plant foods, but this cannot be stated with certainty. The small amount of fire-cracked rock found at the site may indicate the use of fire in any of the activities in practice at the Brennan Site.

Activity Areas

In order to delineate any horizontal artifact clustering, the spatial distributions of various artifact classes (tools, debitage, and fire-cracked rocks) were mapped using each 1 m sq. excavation block as a minimum provenience unit for plow zone soils, and each 50 cm sq. block for sub-plow zone soils. As mentioned in the section on site stratigraphy, movement of artifacts through the profile has been demonstrated. Therefore, artifacts from all levels below the plow zone (Level 1), have been combined into one sub-plow zone sample.

The low numbers of tools, fire-cracked rocks, and non-jasper debitage allowed distribution maps for these classes of artifacts to be created by hand. Distribution maps for jasper flakes were made using the Surfer Program by Golden Software, with a horizontal smoothing factor of 0.9 (a smoothing factor of 1.0 = no smoothing, a factor of 0.0 = total smoothing). Artifacts from Phase II units which fell within the Phase III excavation area are included in the distribution maps.

Figures 19 and 20 show the location of all tools recovered from plow zone and sub-plow zone contexts at the Brennan Site. All of the different tool types present in the assemblage can be found in various parts of the site, but some degree of horizontal separation is evident. Bifaces and biface fragments appear more frequently in the north half of the site (i.e., north of the South 10 line) while utilized flakes and cores are located more to the south. While caution must be used when considering the spatial patterning of plow disturbed and/or naturally disturbed artifacts, it still appears that biface reduction activities were taking place in one area, while the production of flakes from cores, and the activities associated with utilized flakes, were taking place in another.

One small concentration of a particular type of flake tool is also of note. Three of the four flake tools with "notches," (discussed earlier in the report) are located in adjacent units (S9 W31 and S10 W30). In addition, a notched cobble tool was recovered from a third adjacent unit (S9 W30). The activity associated with these unusual tools appears to have taken place in one small area of the site.

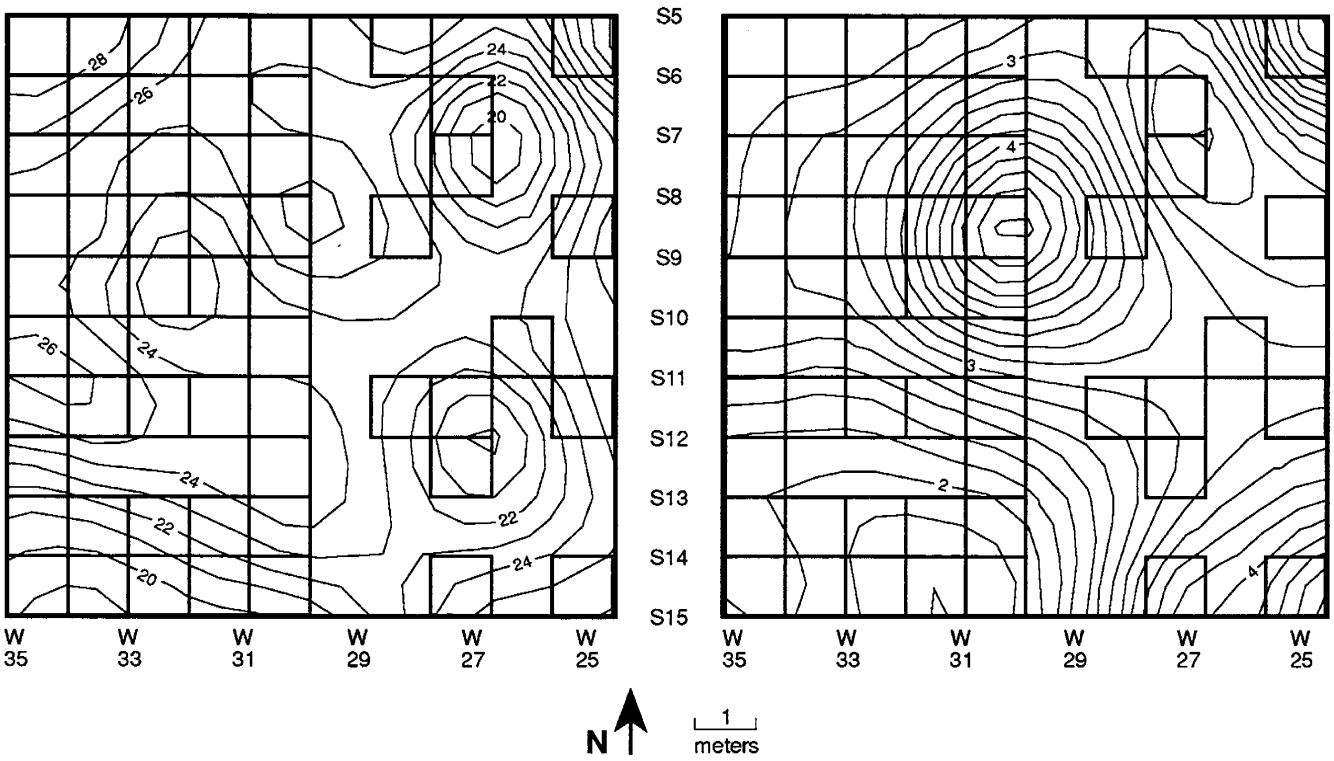
Figures 21 and 22 show the distribution of jasper debitage from plow zone and sub-plow zone soils. As may be seen, jasper flakes in the plow zone are located across the entire site, with some greater amounts in the north half and along the eastern edge of the excavation area. Jasper flakes from below the plow zone generally conform to this pattern, and show a conspicuous concentration around S8.5 W30. It is likely that the reduction of bifaces to create tools produces more flakes than does the reduction of a core to produce flakes, in which the flakes themselves are the desired product. The higher incidence of jasper debitage in the north half of the site therefore corresponds with the activity of biface reduction previously noted. Conversely, the lower but still substantial amount of debitage in the south half reflects the reduction of jasper cores taking place there.

FIGURE 21

Distribution of Jasper Flakes, Level 1, Plow Zone

FIGURE 22

Distribution of Jasper Flakes, Level 2, Below the Plow Zone



The locations of debitage made from raw materials other than jasper are shown in Figures 23 and 24. The number of flakes is small, and they are widely dispersed across the site. A modest concentration of flakes of various materials appears in the southwest corner of the plow zone soils (Figure 23). Sub-plow zone excavations also found a small concentration; seven quartzite flakes were found in the unit S15 W25 (Figure 24). The quartzite flakes have a high percentage of cortex, and refit to one another. They were removed from a flat, tabular cobble, and probably represent a single episode of quartzite cobble reduction.

Figures 25 and 26 are the distribution maps for all artifacts with cortex from the plow zone and sub-plow zone soils. The numbers are small, and like the non-jasper debitage (which accounts for 39% of flakes with cortex) they are widely distributed across the site; no concentrations are present.

Two small concentrations of fire-cracked rock occur below the plow zone (Figure 27). The first is located in Unit S9 W30, and consists of nine rocks. No charcoal or stained earth was associated with the fire-cracked rock. The second location consists of the two fire-cracked rocks found in units S15 W30 and S15 W31. Like the other concentration, no charcoal or stained earth was found. A small amount of fire-cracked rock was also found in the plow zone

FIGURE 23

Distribution of Non-Jasper Flakes, Level 1, Plow Zone

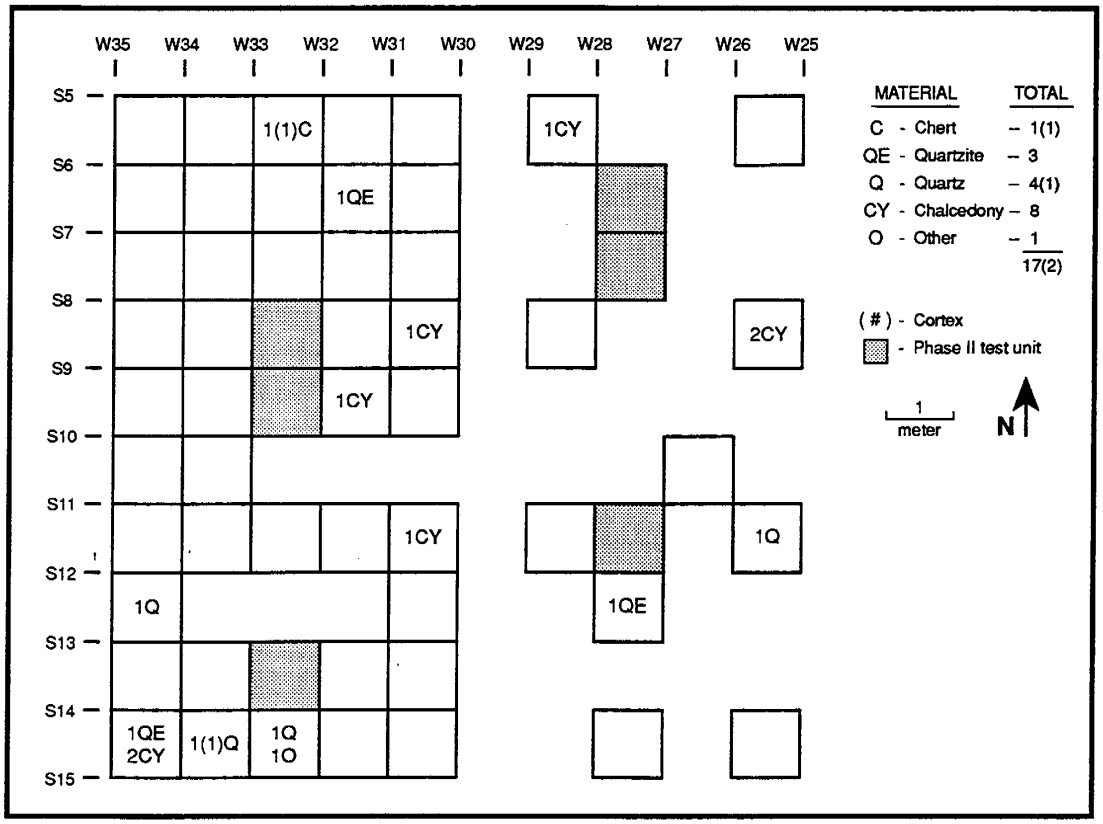


FIGURE 24

Distribution of Non-Jasper Flakes, Level 2, Below Plow Zone

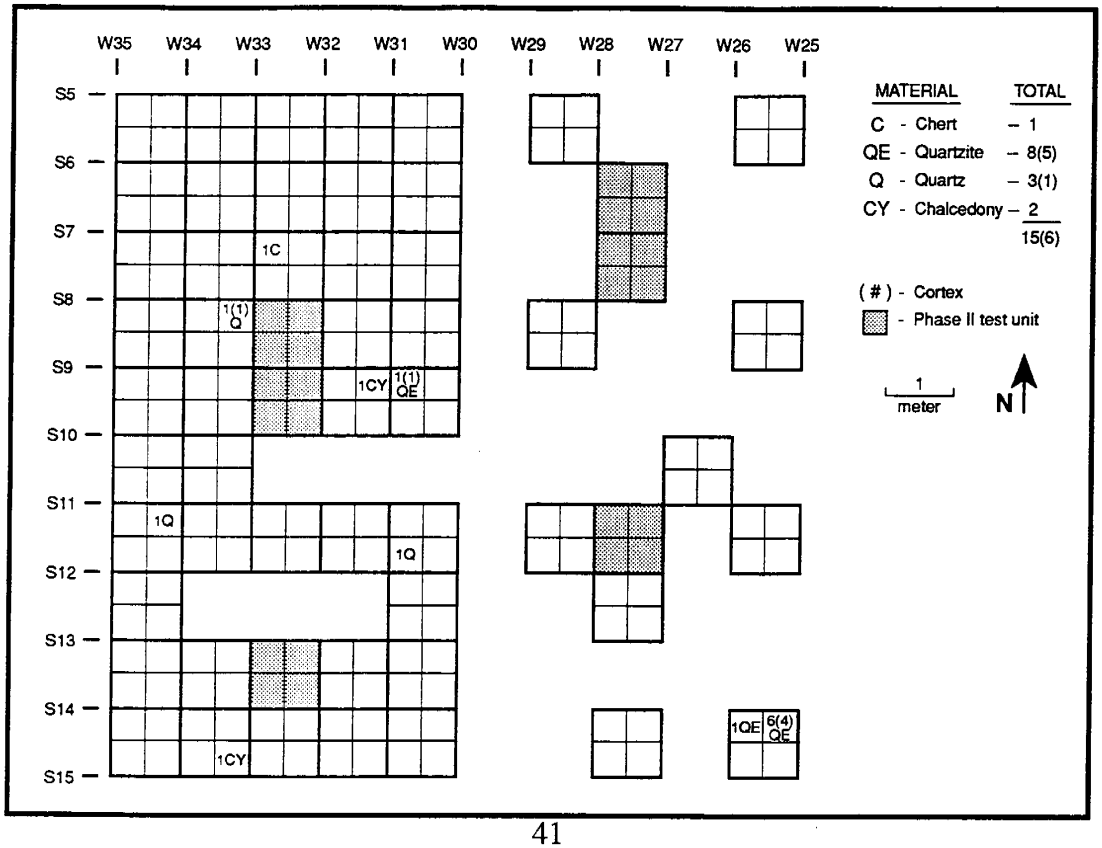


FIGURE 25

Distribution of All Flakes with Cortex, Level 1, Plow Zone

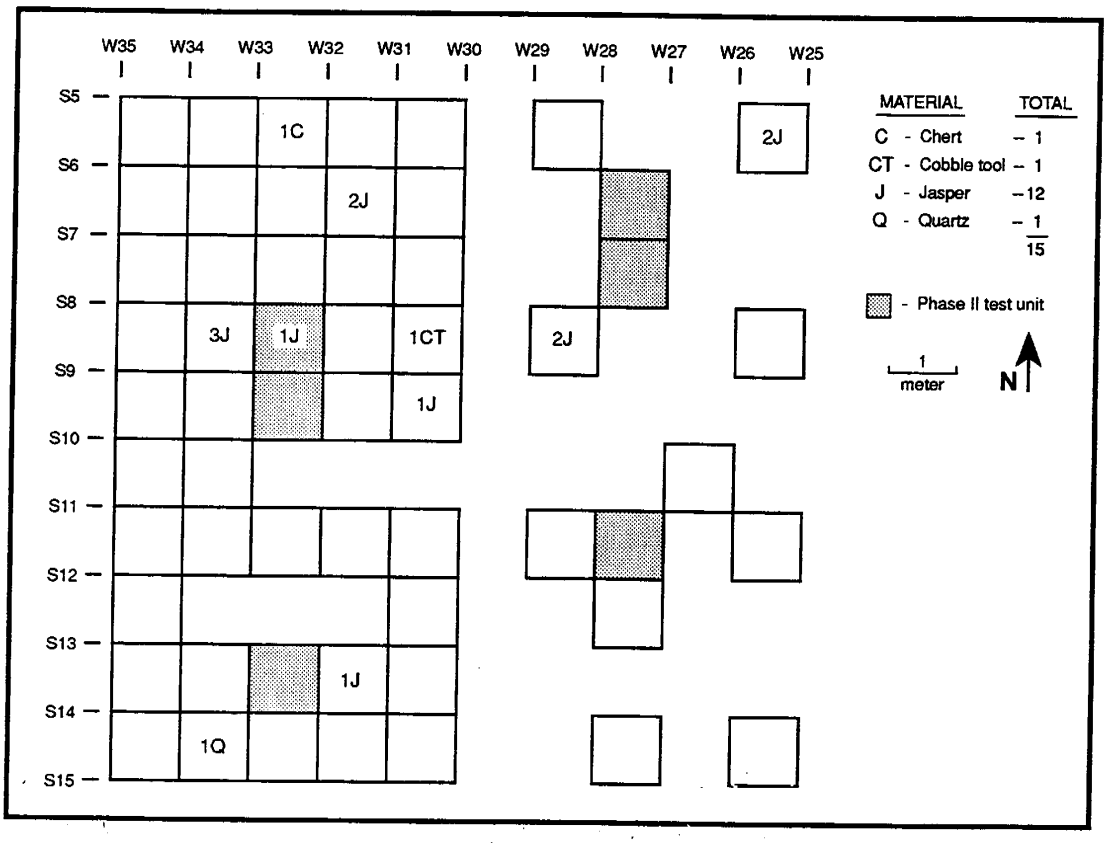


FIGURE 26

Distribution of All Flakes with Cortex, Level 2, Below Plow Zone

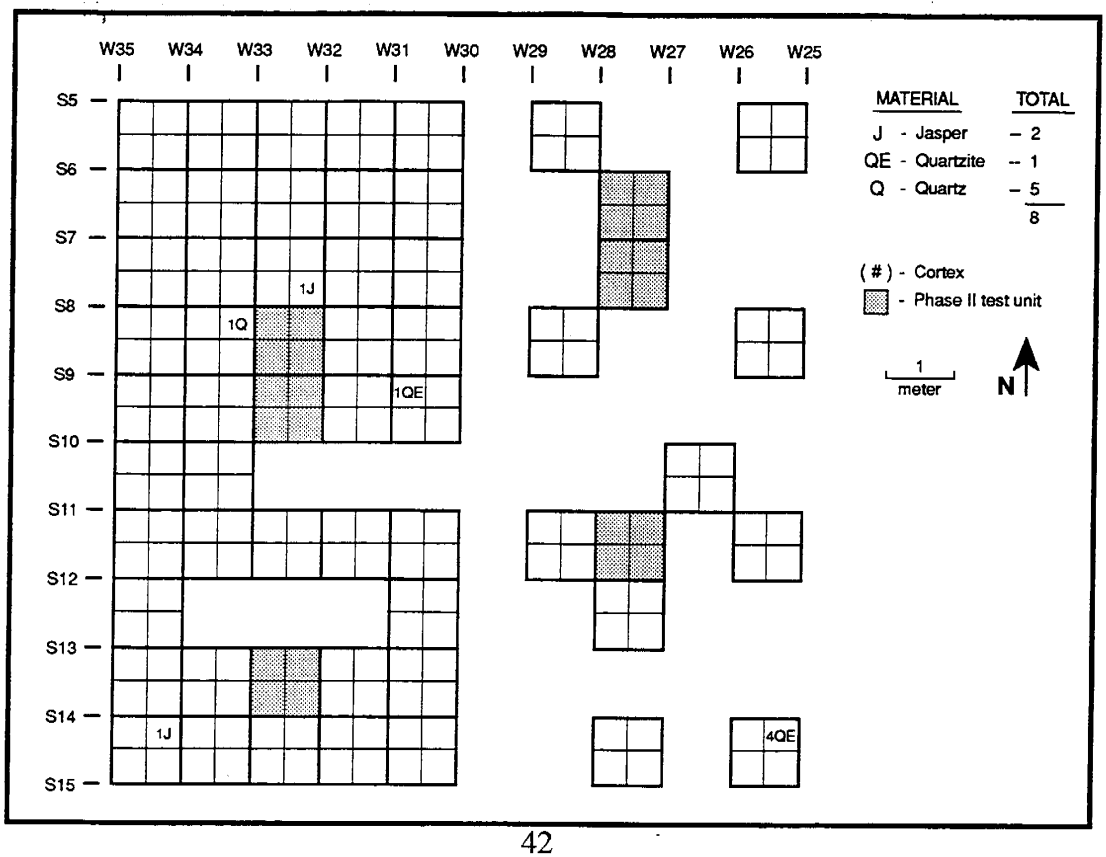
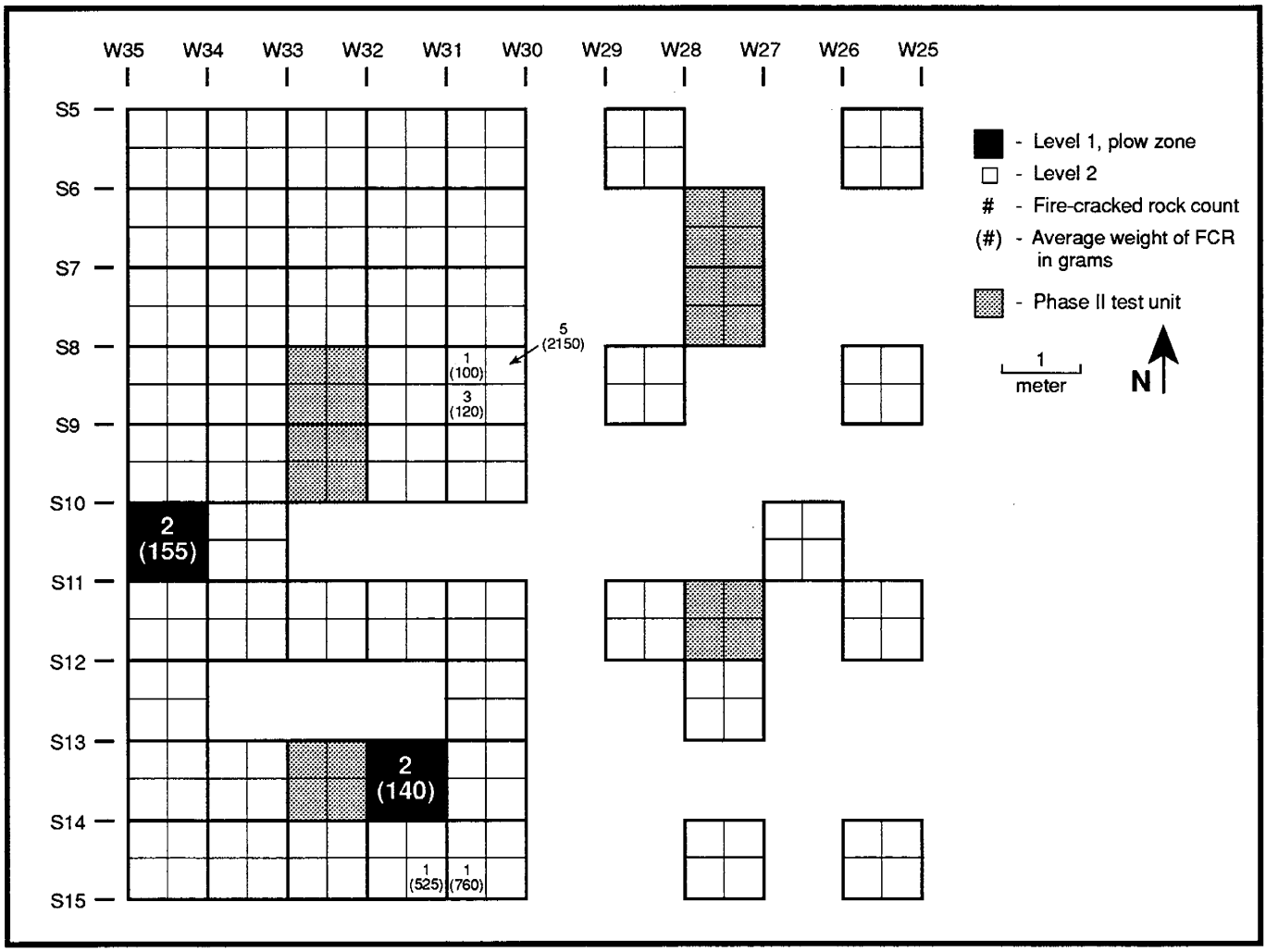


FIGURE 27

Distribution of Fire-Cracked Rock



(Figure 27). The larger collection of fire-cracked rocks in the northern half of the site is the likely location of a hearth. The two fire-cracked rocks further south may represent a second hearth, outside of the excavation area. The small amount of fire-cracked rocks found in the plow zone may have been displaced by plowing from either of the two sub-plow zone locations, or may be from a third disturbed hearth.

Two broadly defined activity areas may be identified at the Brennan Site. In the northern half of the site, jasper biface reduction took place, which produced large amounts of jasper debitage, and a smaller number of rejected bifaces. The vast majority of the jasper is from a primary source, but the presence of non-jasper debitage, as well as jasper and non-jasper flakes with cortex, suggests that a very small number of cobbles or bifaces produced from cobbles were also reduced there. A small number of utilized flakes and flake tools were recovered from the north half, indicating that activities such as plant or animal processing, or the manufacture of

non-stone tools, took place, to a limited degree. The small possible hearth located in the north half of the site may have been used in processing activities, or for warmth. One apparently specialized but unknown activity also took place in this area, utilizing flakes with small notches.

The south half of the site is characterized by smaller numbers of flakes, but a higher incidence of cores and utilized flakes. Activities in the area were probably more domestic, involving the processing of animal and/or plant resources, and possibly cooking. It is likely that the primary jasper cores found here were the source of the expediently utilized flakes. A very small number of cobbles may also have been worked in this area, and a limited amount of jasper biface reduction may have taken place as well.

DISCUSSION AND CONCLUSIONS

The artifact assemblages and their distributions indicate that the Brennan Site functioned as a transient procurement site where the secondary reduction of jasper bifaces was the primary activity. Furthermore, the occupation of the Brennan Site appears to have been associated with quarrying activities at the Delaware Chalcedony Complex (Custer, Ward, and Watson 1986). The stone tool kit is quite limited and is composed primarily of early stage biface rejects, flake tools, and utilized flakes. One late stage biface was also present in the assemblage and two discarded projectile points were recovered in Phase II excavations. The dominant artifact class in the assemblage is waste flakes resulting from the reduction of jasper bifaces and cores. Some edge sharpening also appears to have taken place at the site, as well as a small degree of processing activity. The occupation of the site was long enough to warrant the construction of a hearth, but no evidence of structures was found. The presence of the Brennan Site secondary lithic reduction station at an anomalously large distance from a quarry source has implications for regional settlement patterns and the organization of lithic technologies during the Woodland I Period.

Regional Lithic Technologies

The Brennan Site can be compared with other sites in the Fall Line and High Coastal Plain. Table 8 shows the percentage of cortex and raw material use among a variety of Woodland I lithic assemblages, and Figure 28 shows the locations of the sites from which these assemblages were derived. Due to the various sizes of the artifact assemblages, a difference-of-proportion test (Parsons 1974) was applied to compare the sites listed in Table 8. Although samples from some of the sites are quite small, they can nevertheless be compared with the other sites using the difference-of-proportion test.

Table 9 lists the sites in rank order by percentage frequencies of cortex, cryptocrystalline use, and quartzite and quartz use. Sites with no significant differences in percentages are joined by brackets. Table 9 was prepared from a subset of site comparisons generated in an earlier report (Catts, Hodny, and Custer 1989) to which the Brennan Site was added.